1. Title of the Thesis :

Role of Sponge Iron Industry in the Industrial Development of Chhattisgarh (With special reference to Raipur District)

2. Introduction :

Chhattisgarh is one of the states of India located in the central part of the country. The state is surrounded by Jharkhand state on northwest, Orissa on the east, Andhra Pradesh on the south, and Maharashtra on the southwest. It has been formed from the state of Madhya Pradesh.

Chhattisgarh was recognized as a separate state in 1ST November 2000. The capital of Chhattisgarh is Raipur and the state is divided into twenty seven districts.

Chhattisgarh region is known for its rich cultural heritage as well as for its abundant deposits of natural resources. A variety of mineral resources are found in this region, diamond, gold, iron-ore, coal, corundum, bauxite, dolomite, lime, tin, granite to name a few. Deposits of Kimberlite pipes found in Pailikhand and Deobhog area and gold deposits in Sonakhan area of Raipur district have evoked investor interest. High quality iron-ore deposits are found in the Bailadila hill ranges as well as in Dalhi-Rajhara facilitating the growth of several large Sponge plants in the area. Abundant deposits of lime stone are also found in the districts of Raipur, Bilaspur, Durg and Bastar

The mining and value addition activities through industries provide employment to large sections of Chhattisgarh's population. The State Government follows a sound public policy of exploiting mineral wealth in keeping with sustainability and ecological balance. The State welcomes investment in setting up industries to add value to the natural resources found with in ,and an investor friendly ambience conductive serious business.

Raipur District is situated in the fertile plains of Chhattisgarh Region. This District is situated between 22^{o} 33' N to 21^{o}14'N latitude and 82^{o} 6' to 81^{o}38'E longitude. The District is surrounded by District Bilaspur in North, District Bastar and part of Orissa state in South, District Raigarh and part of Orissa state in East and district Durg in West.

Raipur district plays a vital role in industries. There are so many big & small industries, which are running successfully because of its good market area & available resources. Sufficient raw material like lime stone, gypsum, and other minerals are available in this area. The main industrial area in the Raipur zone is situated in Urla, Siltara and Mandir Hasoud . Some of the main industries are:

Godawari Power & Ispat Ltd.
Jindal Steel & Power Ltd.
Raipur Ferro Alloys
Aarti Sponge Iron
Monnet Ispat & Energy Ltd.
Vanadana Ispat Ltd.

Raipur Ispat Private Ltd.
SKS Ispat Ltd.
Sarda Energy & Min Ltd.
Shri Bajrang Power and Ispat Ltd.

Industrial Development

Industrial development is fundamentally a process of structural transformation. This involves the reallocation of productive factors from traditional agriculture to modern agriculture, industry and services. This process involves shifting resources from low- to high-productivity sectors.

Industrial development is essential for all round development of any state. No state can prosper by relying on the growth and development of any one sector. It has to make efforts for development of agriculture as well as for small and large scale industries for the balanced growth of state.

Chhattisgarh has been famous for its rice mills, cement and steel plants. Raipur, Durg, Raigarh, Korba and Bilaspur are the leading districts in the field of industrial development in the State. The establishment of BSP in the 1950's led to the development of a wide range of industries at Raipur and Bhilai. Raipur district has got the rare distinction of having the largest number of big and small-scale cement plants. Bilaspur and Durg districts, too, are home to a number of large-scale cement plants. Korba, with a number of power generating units established by NTPC is among the leading power generation centers in the country. There are

a number of industrial growth centers in the State which host hundreds of industrial units. The principal growth centers in the State are - Urla and Siltara (Raipur); Borai (Durg) and Sirgitti (Bilaspur).

Sponge iron

Sponge iron, also known as Direct Reduced Iron (DRI), is a product that is produced by subjecting iron ore to a reduction process. The iron ore is often in the form of pellets or lumps, and is subjected to a reduction process that is created by the use of a reducing gas that emits from coal or a natural gas source. Iron ore is -directly reduced- in the solid state, using either natural gas or non-coking coal, to produce a highly metalized material, referred to as sponge iron. It is further melted in electric arc furnaces (sometimes in induction furnaces) to produce liquid steel. This methodology enables steel to be produced without using coking coal, which is an expensive input in the normal blast furnace-basic oxygen furnace route of steel making adopted in integrated steel plants. Sponge Iron is a substitute to scrap.

In modern times, sponge iron has found increasing use in the manufacture of wrought iron and as substitute of scrap during steel making. Sponge iron is chemically more active than steel or iron millings, turnings or wire strips. Sponge iron is produced as granular material or as sintered mass, depending upon the methods of treatment applied to hot material. In the granular form, it is commonly known as powdered iron and used in the manufacture of many useful articles by the techniques of powder metallurgy.

DRI(Direct Reduced Iron) Production Scenario in Chhattisgarh

Chhattisgarh is one of the largest producers of sponge iron in India. In 2007-08, the state produced 5.20 MT of sponge iron accounting for about 26 per cent of the total sponge iron production in the country. During 1999-2000, only seven plants were operating in the state. In a span of seven years, the number increased to 65 registering a nine-fold increase. An estimate of the number of working plants in Chhattisgarh for 2010-11 was 95 with a working capacity of 7.5 MTPA.

Chhattisgarh is dominated by small scale plants with production capacities between 0.0075 to 0.033 MTPA. The state has 29 small scale (43%), 23 medium scale (34%) and 16 large scale plants (24 %). Raipur has 75 per cent of the plants in the state followed by Raigarh (16 %). The plants in these two districts are mostly present in clusters. Siltara cluster in Raipur district has 32 plants. Urla is a cluster of 11 plants also situated in Raipur. In terms of plant capacity, small scale plants contribute a meager nine per cent of the total capacity of eight MTPA in the state . Medium scale plants contribute about 22 per cent to the total capacity and even though the number of large scale plants is the lowest, their contribution to the total capacity is as much as 70 per cent.

DRI Production Scenario in India

India is the world's largest producer of sponge iron, accounting for 13% of the global production. Sponge iron is produced using either coal or natural gas. Since coal is available in India, the sector largely depends on coal based sponge iron which contributes about 80 per cent of the total capacity in the country. It is not possible to ascertain the exact number of sponge iron plants in India due to non-reporting by many small scale players . Based on our analysis, there are 333 sponge iron plants in the country.

The present DRI production capacity is approximately 36 million tons per annum with last year production 20.37 MT. Of the total capacity, 330 plants are coal-based with a capacity of 29.2 MTPA while three are gas-based with a capacity of about 7.5 MTPA. Among the coal based DRI plants, Jindal Steel is the world's largest with total capacity of 1.37 MTPA. The gas based plants are Essar Steel (Gujarat), Ispat industries (Maharashtra) and Welspun Power (Chhattisgarh). Essar Steel is the world's largest gas based single location DRI plant with a capacity of 5 MTPA. Ispat Industries has a capacity of 1.6 MTPA and Welspun Power is a small gas based DRI plant.

Most of the sponge Iron Plants are coal based plants and very few plants are gas based plants. Almost 35% of DRI production in India in year 2003-04 was through coal-based process compared to 80% in year 2011-2012. This clearly shows an increasing trend on use of coal for sponge iron making. The coal based kiln capacity ranges from as small

as 50 tons/day to as high as 500 tons/day. The largest coal based plant in India is Jindal Steel & Power Limited, located at Raigarh in Chhattisgarh State. This is also the world's largest coal based plant. The largest gas based DRI plant complex in India is 2.40 million tons per annum DRI / HBI plant of Essar Steel Limited, located at Hazira in Gujarat State.

World DRI Production Scenario

All over the world, blast furnace will continue to remain the chief source of pig iron / molten metal for use in steel making because of its superior technology, higher conversion efficiency, product quality and achieving stringent environmental norms. DRI contributes only meager 3-4% of the world's total iron making with an output of about 49.5 million tons per annum. Most of the DRI plants in the World use natural gas as reductant, whereas the DRI plants of India using coal as reductant constitutes almost two third of the production capacity.

The major part of DRI produced all over the world is used as a substitute for steel scrap in the Electric Arc Furnace (EAF) and Induction furnace (IF) while making steel. Countries that have plenty of steel scrap available in domestic market or countries that have taken policy decision to maximize steel scrap recycling by way of reduced custom duty do not favour DRI process.

3. A Brief Review of the work already in the field:

1. Title of Research Work: A study on liquidity management of Indian Steel Industry.
   Researcher: M Mahesh Barad

2. Title of Research Work : Raipur Sambagh ke Audyogik Vikas Mein chuni hui sansthaon ki bhumika
   Researcher : Mrs. Maya Lalwani

4. Objectives:

- To Study the role of Sponge Iron Industry in the industrial development of Chhattisgarh
- To find the current scenario and future prospects of sponge Iron Industry in Chhattisgarh
- To study the employment opportunities provided by the Sponge Iron Industry
- To study the use of sponge Iron as raw material in other industries
- To study the utility of by-products of Sponge Iron Industry in the Industrial field

5. Noteworthy Contribution in the field of Proposed Work:

The following research work on Sponge Iron Industry will help to know their importance in the industrial development of Chhattisgarh. It will also make us aware of the present condition and future prospects of Sponge Iron Plants in Chhattisgarh. This research work will also enable to know the problems faced by the Sponge Iron Industry. It will help to know the new areas of expansion and different alternatives available for solution of problems faced by the Sponge Iron Industry. It will help us to know how Sponge Iron Industry can be made more effective in the Industrial development of Chhattisgarh.

6. Proposed Methodology:

Primary data as well as secondary data both will be used for research purpose. Primary data will be collected by questionnaire method from employees, employers of Sponge Iron Industry and their customers i.e the beneficiaries of product (Sponge Iron). Secondary data can be collected from Excise Department, different Government bodies Association of Sponge Iron Industry and different sponge Iron Units.

7. Hypothesis:

- Sponge Iron Industry will help in the Industrial Development of Chhattisgarh
- Future of Sponge Iron Industry in Chhattisgarh is very bright
- Sponge Iron Industry will also be helpful in the creation of new employment opportunities in the state.

8. Expected Outcome of the Research:

This research work is carried out with the aim to find out the role of Sponge Iron Plants in the Industrial Development of Chhattisgarh, and their role in the creation of employment opportunities as compared to other industries. This research work will also help to know the future of Sponge Iron Industry. Through this research work different problems faced by the Sponge Iron Industry can be known. We can find different options available for the solution of problems faced by the industry.

9. Steps of Research Work

Chapterisation:

CHAPTER – 1

Introduction

1.1. Profile of Chhattisgarh
1.2. Profile of Raipur District
1.3. Industrial Development of Chhattisgarh
1.4. Sponge Iron Industry

CHAPTER - 2

Research Methodoloy

2.1 Meaning of Research Methodology
2.2 Characteristics of Research Methodology
2.3 Kinds of Research Methodology
2.4 Methods used in this Research Work

CHAPTER – 3

Objectives and Hypothesis

3.1 Objectives
3.2 Hypothesis
3.3 Limitations of this research work

CHAPTER - 4

Sponge Iron Industry in Raipur District

4.1 Sponge Iron
4.2 Classification of Sponge Iron Industry
4.3 Types of Process Technology

4.4 Sources of Raw Materials
4.5 Preferred Raw Material Characteristics
4.6 Typical Product Characteristics
4.7 Major Facilities of Coal Based DR Plant
4.8 Technology Options for Coal Based Plants
4.9 Gas Based Processes
4.10 Major Facilities of Gas Based Plant
4.11 Typical Raw Material Characteristics
4.12 Typical Consumption Of Raw Materials & Services
4.13 Comparative Study of Production, Sales and Profitability of Selected Sponge Iron Industries

CHAPTER – 5

Problems of Sponge Iron Industry

5.1 Problems of Employees
5.2 Problems of Employers
5.3 Problems of Customers

CHAPTER - 6

Suggestions

CHAPTER - 7

Future of Sponge Iron Industry in Chhattisgarh

CHAPTER - 8

Limitations of the Study

8.1 Study of Sponge Iron Industry of Raipur District only

8.2 Study of only Selective Large Sponge Iron Plants of Raipur

CHAPTER - 9

Conclusion

CHAPTER – 10

Bibliography

10.1 Reference Books

10.2 Research Magazines

10.3 Newspapers

10.4 Websites

10.5 Journals Of Sponge Iron Industry

10.6 Questionnaire used in the Research Work

10. Bibliography:

S.no	Book Name	Name of Author	Name of Publisher	Edition
1.	Sponge Iron Production In Rotary Kiln	Sarangi Bidyapati	PHI Pvt. Ltd.	
2.	Sponge iron production by direct reduction of iron oxide	Amit Chhaterjee	PHI Learning Pvt. Ltd.	
3.	Advances in Rotary Kiln Sponge Iron Plant	Hem Shankar Ray	New Age Publishers	Ist Edition

4.	Business Environment	Dr. V.C Sinha	SBPD Publishing House	
5.	Business Environment	Dr. Francis Cherunilam	Himalaya Publishing House	14th Edition
6.	Business Economics	Dr V.C Sinha	SBPD Publishing House	
7.	Research Methodology: Methods and Technique	C.R Kothari	New Age Publishers	2nd Edition
8.	Research Methods for Business Students	Mark Saunders, Philip Lewis, Adrian Thornhill	Pitman	Ist Edition
9.	Fundamentals of Statistics	D.N Elhance Veena Elhance B.M Aggarwal	Kitab Mahal	58th Edition
10.	Statistical Methods	Dr. S.P Gupta	Sultan Chand & Sons	34th Edition
11.	Business Statistics	Dr. S.M Shukla Dr. S.P Sahai	Sahitya Bhawan Publications	
12.	An Introduction to Statistical Methods	C.B Gupta Vijay Gupta	Vikas Publishing House Pvt. Ltd.	23rd Revised Edition

Websites

www.indeed.co.in

www.google.com

www.steelworld.com

www.wisegeek.com

www.sksispat.com

www.cseindia.org

www.economictimes.com

www.mines.gov.in

www.chhattisgarhabout.in

www.chhattisgarh.nic.in

www.chhattisgarh.gov.in

www.spongeironindia.org

www.cseindia.org

www.economictimes.com

fsnl.gov.in

cdm.unfccc.int

Guided By	Co-Guided By	Submitted By
Dr. G. D. S. Bagga Professor of Commerce C.L.C. Govt. College DHAMDHA, Distt.-Durg (C.G.)	Dr. S.S Khapuja	Mr. Mukesh Bhojwani
Asst. Professor (Commerce)	Principal	Asst Prof. (Commerce)
C.L.C Govt. Arts & Commerce	Durga College	MATS University, Raipur
College, Dhamdha, Durg (C.G)	Raipur (C.G)	